

New records of the mourning gecko *Lepidodactylus lugubris* (Duméril and Bibron, 1836) (Squamata: Gekkonidae) from Colombia

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ABSTRACT: The mourning gecko (*Lepidodactylus lugubris*) is a nocturnal, parthenogenetic species that has been introduced in Colombia. Despite more than 70 years of collecting activity in the country, there has yet to be a thorough evaluation of its distribution in Colombia. Here we review all records from eight museum collections, along with literature reports, to generate a locality map documenting this gecko's distribution in space and time. Additionally, new sightings are reported and its range expansion in the Cauca rift valley is discussed.

The mourning gecko (*Lepidodactylus lugubris*, Figure 1) is widely distributed throughout much of the Indo-Pacific region (Bauer 1994), while in the New World it has been introduced in Pacific coastal areas of the mainland of Mexico, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, and Chile (Smith and Grant 1961; Schauenberg 1968; Henderson *et al.* 1976; Kraus, 2009; Uetz 2011) as well as the Galapagos (Wright 1983; Jadin *et al.* 2009) and Easter Island (Garman 1908). More recently, it has also been recorded in Atlantic and Caribbean coastal areas from Panama, Suriname and Guadeloupe (Bauer *et al.* 2007; Lorvelec *et al.* 2011). In Colombia this species is most common in the Pacific region, throughout the lowlands and Pacific versant of the western range of the Andes, in the southwestern departments of Valle del Cauca, Cauca, Nariño, and on Gorgona Island. Additionally, there are intermittent records documenting it in the city of Santiago de Cali (Ayala 1986; Castro-Herrera and Vargas-Salinas 2008).

Despite over 70 years of collecting activity in the region, the distribution of this species in Colombia remains unclear. In a recent herpetofaunal inventory (Castro-Herrera and Vargas-Salinas 2008) it was recorded in the Valle del Cauca in the Pacific region, the western range of the Andes (Cordillera Occidental), and the Cauca rift valley (Valle interandino del río Cauca). Both *L. lugubris* and "*Hemidactylus brookii*" (all or most New World "*H. brookii*" are actually assignable to *H. leightoni* or *H. haitianus*, members of the *H. angulatus* group that have probably been introduced from mainland Africa [Powell and Maxey 1990; Powell *et al.* 1996; Rivas 2002; Weiss and Hedges 2007], whereas true *H. brookii* is restricted to tropical Asia [Bauer *et al.* 2010; Rösler and Glaw, 2010]) have been hypothesized to have reach Colombia via cargo ships during the Spanish colonial period in the Americas from 1492 to 1898 (Castro-Herrera and Vargas-Salinas 2008). Although today there is a general idea of the dissemination of this species, a revision of all available records is required

in order to better understand its current distribution and its pattern of colonization. For example, it is known that this species is more abundant in the Pacific region, while its presence in the Cauca rift valley is based on sporadic records, and it has not been recorded in the Yotoco forest, a locality on the east slope of the western range of the Andes, despite extensive herpetological survey work over a 30-year period (see Castro-Herrera *et al.* 2007).



FIGURE 1. *Lepidodactylus lugubris* (UVC 14948). Specimen collected in San Cipriano, Valle del Cauca (photograph by Richard Thomas).

We reviewed the literature and collection data from eight zoological collections (Appendix 1). We used these data to generate a new distribution map (Figure 2) using ArcGIS 10.0 (ESRI, Redlands, CA, USA) that represents the

distribution of the species in space and time. Our map includes 24 localities, including recently published records, unpublished records from the Caribbean and Andean regions from Colombia, and new sightings. Although many records include specific geographic coordinates, for those where this information was not available we have approximated by mapping the records in the smallest geographic unit that is consistent with the collection data. Localities on the map are color-coded in 20-year intervals based on the date specimens were collected in order to facilitate visualization of their temporal distribution within Colombia since the earliest record to the present time.

The earliest record of *L. lugubris* in Colombia dates to 1941, based on a single specimen collected by Robert C. Murphy in Tumaco (Nariño, AMNH R-63567) during the Askoy Expedition to the areas between the Gulf of Panamá and Guayaquil (Ecuador). In Colombia this expedition covered the pacific shoreline, Malpelo and Gorgona (Murphy 1941). In the literature, this species is first mentioned from Colombia by Mechler (1968), who inferred its presence based on his review of specimens from Panamá and Ecuador. The oldest recorded specimen from the Cauca rift valley was collected in Santiago de Cali by Vernon Lee (USNM 151576) in 1963. Today only four records are known from Santiago de Cali. According to the dates of collection and personal observations (JDD),

L. lugubris is thought to have had a sporadic presence in Cali since the time it was first collected at this locality. Only recently does it appear to have become established in this area. Until this point, it may have been inhibited by the larger, more dominant "*Hemidactylus brookii*", which is a more conspicuous species in this area and has been suggested to have niche overlap with *L. lugubris* (F. Castro personal communication).

Based on the data gathered, we suspect that colonizing *L. lugubris* first arrived in the Colombian Pacific region after the Spanish colonial period (early 20th century). It is almost certain that the voluminous traffic of ships crossing the Pacific Ocean, especially after the opening of the Panama Canal, is responsible for its introduction in the Americas (Smith and Grant 1961) and not European cargo ships crossing the Atlantic and Caribbean. This introduction in the Americas is also likely to be a consequence of repeated colonization events from different sources at multiple localities along the Pacific shoreline. The populations are likely to have first established in Colombia along the southwestern Pacific coast, where several important port cities are located (e.g., Buenaventura, Tumaco). After these initial populations were established, *L. lugubris* likely became widespread and dominant throughout the Pacific lowland region, including Ecuador (Schauenberg 1968). Some geckos subsequently moved eastward to higher elevation localities in the Cauca rift valley (between 900

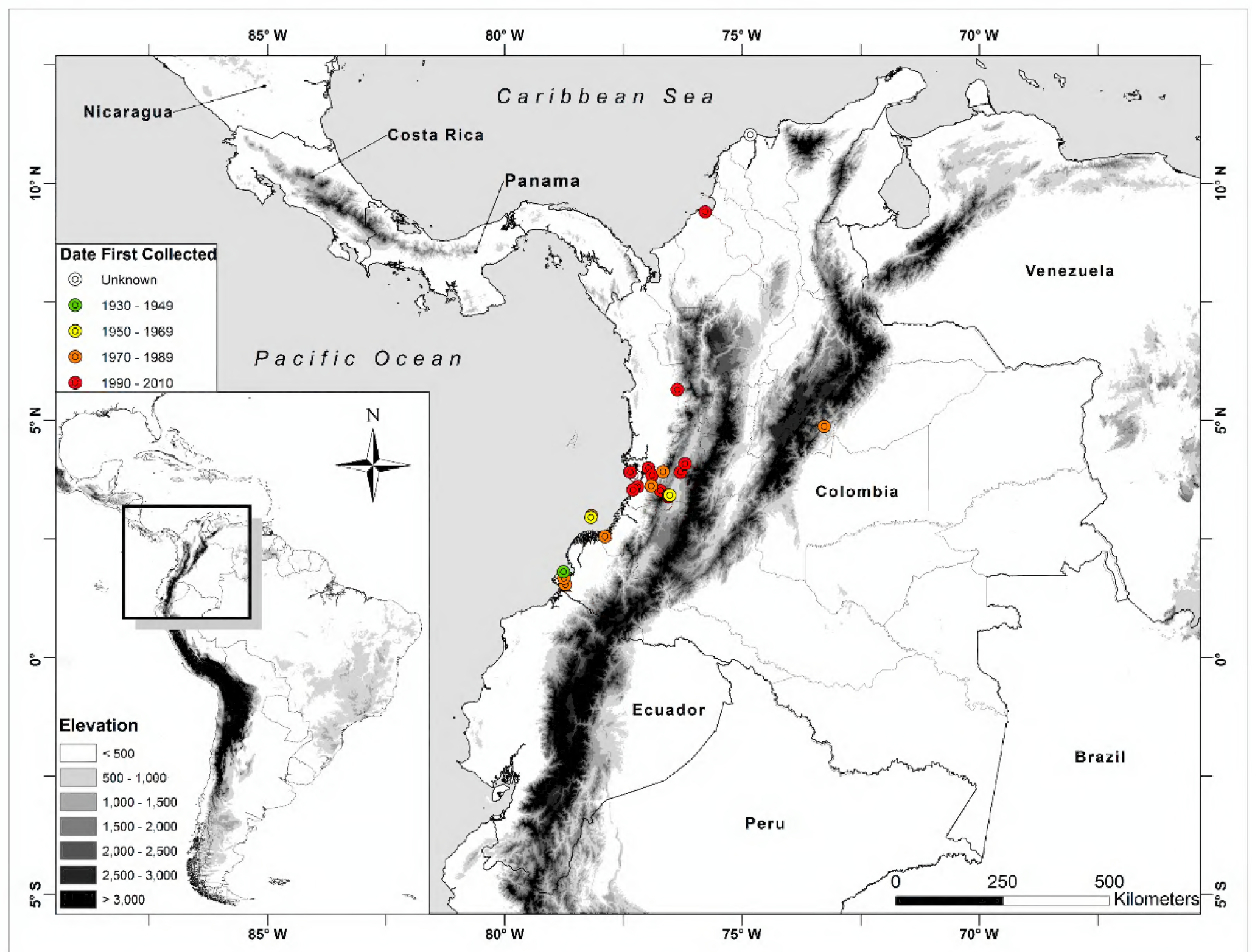


FIGURE 2. Localities of *Lepidodactylus lugubris* in Colombia.

and 1000 m). Since Santiago de Cali is separated from the Pacific lowlands by higher elevations (above 2000 m), the invasion of this zone was probably facilitated by terrestrial transport of foreign and local freight such as lumber through two main roads, Buenaventura-Cali and Buenaventura-Buga. In the Cauca rift valley localized populations went from numerically rare to dominant over a period of at least 50 years, a process that appears to have accelerated in the last five years.

Like conspecifics in other parts of the world, Colombian *L. lugubris* are parthenogenetic and reproduce clonally (Orozco-Cardona 1996). We have not confirmed the clonal identity of all Colombian populations, but specimens from Valle de Cauca (Fig. 1) appear to belong to the chief Central and South American clone as identified by Ineich (1999) and to be rather similar in dorsal pattern to the Easter Island clone (Ineich and Ota 1993). Ineich (1999) postulated that *L. lugubris* has had a long presence in the Americas, as supported by its apparently endemic clone and broad distribution, but our data suggest that its spread has been relatively recent, at least in Colombia.

Previous herpetological surveys did not report this species in the Chocó Department (Castaño-Mora et al. 2004; Dixon 1979; Ruiz-Carranza et al. 1993), but a recent study (García Rentería et al. 2006) recorded it in San José de Pururé near Atrato town, this being the northernmost record for this species in the Pacific region of Colombia.

We found some records from the Caribbean region (Cordoba and Atlántico, ICN 10399; UVC 15627–15629), where this species was unknown or was not reported in a recent regional scientific survey (Carvajal-Cogollo et al. 2007). Aside from a record from Suriname (Bauer et al. 2007), these are the only reported occurrences of *L. lugubris* from the South American mainland east of the Isthmus of Panama. Although there are only two records from this region, this opens several questions: 1) when was this species introduced in the Colombian Caribbean?; 2) are these specimens derived from colonizing individuals from the Pacific region or did they disperse from established Caribbean populations from Central America? (e.g., Panama, Bocas del Toro area); and 3) are these populations continuous with the Pacific populations or disjunct?

An unexpected record was one from Boyacá, in a locality on the eastern versant of the eastern range of the Andes from an altitude of about 1000 m. Given the geographic barriers that separate this locality from the Colombian coastal regions, this specimen is very likely to have arrived by anthropogenic transportation.

The extent of the invasion of Colombia by *L. lugubris* and its ecological impact on the native biota, especially other gekkotans, is still unclear. In Colombia the scarcity of native nocturnal geckos opens up opportunities for the expansion of *L. lugubris*. On the other hand, parthenogenesis and the presence of more aggressive and larger *Hemidactylus* geckos can reduce its population density considerably either by direct factors such as predation of juveniles, or indirect factors such as stress-induced decrease in reproductive output or competition for illuminated foraging areas or daytime retreat sites (Bolger and Case 1992; Petren et al. 1993; Hanley et al. 1994; Brown et al. 2002). *Lepidodactylus lugubris* is reluctant to share

foraging areas and daytime retreat sites with *Hemidactylus* geckos, which may prey upon the smaller mourning gecko (Petren et al. 1993; Brown et al. 2002). This behavior may be a limiting factor for the expansion and establishment of the Colombian populations. A more complete sampling across the country is required in order to provide a better understanding of the distribution of this non-native species in Colombian territory. Also, continued monitoring of *Lepidodactylus lugubris* and *Hemidactylus* aff. *angulatus* (= *H. brookii* in literature records) may help to understand the interactions between these two invasive species.

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APPENDIX 1. Locality and collection date (DD/MM/YY) information for Colombian specimens of *Lepidodactylus lugubris*. Collection acronyms follow Leviton et al. (1985) and Sabaj Pérez (2010).

CHOCÓ: ATRATO: San José de Purré (March–October 2003, García Rentería et al. 2006). **VALLE DEL CAUCA:** BUENAVENTURA: Bajo Anchicayá: BMNH 1980.373-374 (28/V/1976), ICN 3061–3062 (30/05/1976), ICN 3067, ICN 3100 –3104, ICN 3105–3106 (04/06/1976), ICN 3063 (05/06/1976), ICN 3064–3066, ICN 3068–3070 (08/06/1976), MCZ R154445 (1/9/1977), MVZ 190572–190579 (20/7/77), KU 192645–192647, ICN 3099 (07/04/1978), UVC 6–7 (27/5/1980), UVC 264, UVC 5054, UVC 5055, 5057–5067 (2/3/83), UVC 266–269 (12/4/1984), UVC 5085–5086 (27/9/85), UVC 9736 (23/10/92); Cuartel B-IV-5 Concesión Bajo Calima: UVC 11049-11050; Campamento Pulpa de Papel: UVC 11142 (10/9/1992); Desembocadura del Río Mayorquín: UVC 14649 (28/07/2001); Isla Palma: UVC 15631 (17/12/2009); Río Cajambre, Punta Bonita: UVC 14647 (5/7/2001); Queremal: ICN 7076 (6/5/1993); Pianguita: UVC 15778; San Cipriano: UVC 14948–14953 (27/12/2006). CALIMA: ICN 3087 (18/08/1977). GUADALAJARA DE BUGA: (23/12/2010, 3°54'5.00"N, 76°18'6.85"W), SANTIAGO DE CALI: USNM 151576 (13/02/1963); Barrio El Lido: ICN 3084 (27/03/1979), Barrio Champagnat: UVC 270 (28/7/1984), UVC 9805 (14/11/92), Barrio Nápoles (25/12/2010, 3°23'17.22"N, 76°32'56.76"W). TULUÁ: (23/12/2010, 4° 4'60.00"N, 76°12'0.00"W). **CAUCA:** FMNH 166248 (20/7/1965), AMNH R-109815-109820 (2/2/73). GUAPI, Bonanza: ICN 3071–3075 (15/08/1976); ISLA GORGONA: ICN 652 (03/02/1961), ICN 3109, ICN 3085–3086 (06/04/1977), ICN 3088 (04/07/1978), ICN 3089–3098, (___/08/1978), ICN 3087 (18/08/1977), ICN 051970 (27/03/1979), ICN 3110 (20/05/1979); Campamento del Penal UVC 5088–5090 (1/5/82), UCV 5069-5070 (2/4/83), UVC 5071-5081 (21/4/83), UVC 5082-5084 (12/7/83), UVC 265 (4/4/84), UVC 7324-7325 (7/2/87), UVC 7812 (13/1/89), UVC 5078. La Esperanza: ICN 3108 (22/05/1979). **NARIÑO:** AMNH R- 108308, FMNH 16249 (11/7/1965); LA GUAYACANA: ICN 3107 (16/10/1978). TUMACO: AMNH R-63567 (19/4/1941). El Mira: ICN 3076 (17/11/1976), ICN 3077–3081, (25/11/1976), ICN 3082 (29/11/1976); El Tangarial: ICN 3083 (08/12/1976). **BOYACÁ:** SANTA MARÍA, km 2, carretera a Guateque: ICN 5826 (26/01/1981). **CORDOBA:** SAN ANTERO, Bahía Cispatá - Amaya, INVEMAR: ICN 10399 (21/09/2000). **ATLÁNTICO:** BARRANQUILLA: UVC 15627–15629